Alberta
DEPARTMENT OF HOUSING

Innovative Housing Grants Program

ASSESSMENT OF THE ENERGY SAVING MEASURES USED IN THE ER-1 CONSERVATION/SOLAR RESEARCH HOUSE

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Introduction

The research house, ER-1, was built to demonstrate and measure the results of a variety of energy saving measures integrated within a standard house. These energy saving measures incorporate passive solar energy, supplementary wood heating and super insulation levels coupled with energy recovery, storage and distribution systems.

Monitoring Program

A computerized program was developed to monitor air, water and soil temperatures, solar energy gains, water, electricity, wood consumption, and relative humidity.

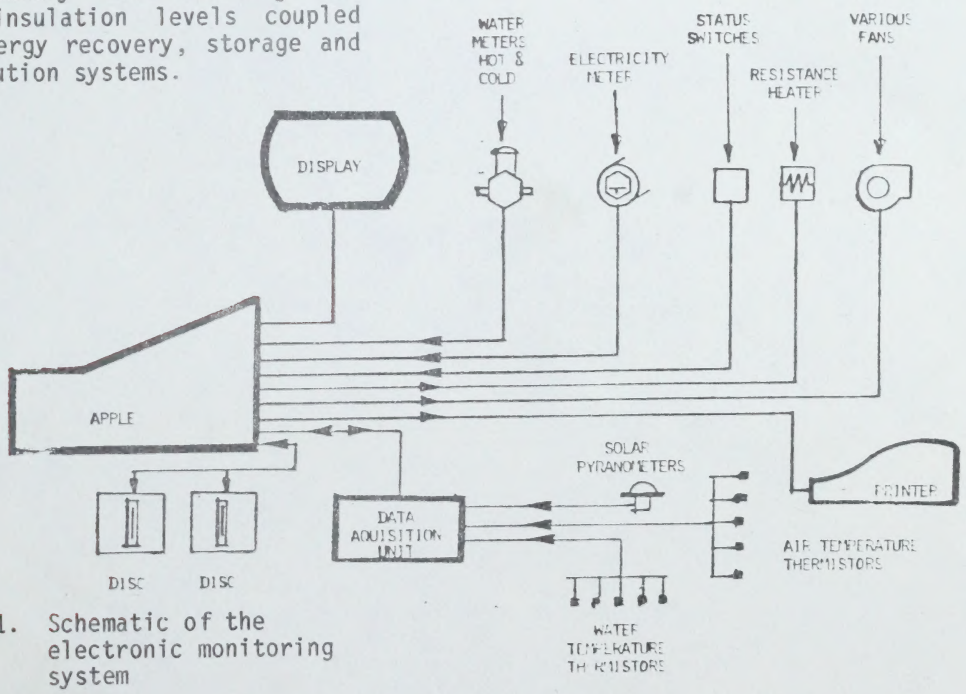

Figure 1. Schematic of the electronic monitoring system

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Building Envelope

The above grade walls have an RSI value of 5.5 (R-31) and the ceilings have an RSI value of 7.9 (R-44). The 135 micrometer (6 mil) poly vapour barrier was sealed with accoustic caulking resulting in an air infiltration rate of 0.06 air changes per hour. With the use of triple glazing the calculated heat loss at - 37C was 6500 watts.

Solar Energy System

The solar energy gain was electronically monitored with sensors that determined incoming solar energy on various areas of the house. The design analysis estimated that approximately 60% of the annual supplemental space heating requirements would be supplied by solar energy.

Triple Glazing

Triple-glazed windows were assessed for effectiveness in reducing condensation and night time window heat loss. Condensation and some frosting did occur on the lower edges of the windows at extreme temperatures. Considering the alternatives, triple glazing was considered the most practical window treatment.

Fresh Air Heat Exchanger

A fresh air heat exchanger was installed to control humidity levels, enhance indoor air quality and to recover heat from waste house air. The unit worked well, recovering approximately 70% of the heat from waste air and it did not frost up even in severe weather conditions.

Heat Storage Bank

The practical aspects of a short term heat storage bank were studied. The heat storage bank consisted of 447 trays of Glauber's salt phase change material, located in an insulated compartment. Air from the ceiling of the house was directed through the stacked trays for heat removal (cooling mode) or addition (heating mode). The cooling mode of the heat bank worked well. The storage of heat produced uncertain results.

Use of the Wood Burning Stove

A wood burning stove was installed to function as a primary wintertime heat source. Actual savings by burning wood from the site cleared for the ER-1 house on space heating costs were $240 during the first year compared to the cost of electric heat. While operation of the stove was not difficult, it required extra personal effort.

Conclusions

The costs, benefits and inconveniences of the energy-saving measures were assessed and compared. The total net costs were $3400. The first year return on investment was 25%, resulting in a simple payback period of four years. The net contribution of the energy conserving measures provides 59% of the total heating requirements for the ER-1 house.